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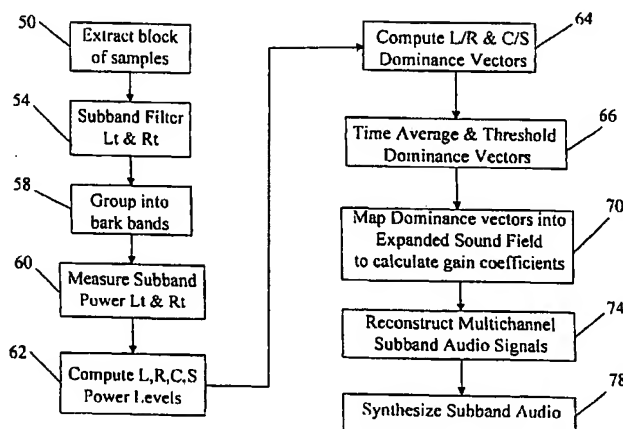
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF DECODING TWO-CHANNEL MATRIX ENCODED AUDIO TO RECONSTRUCT MULTICHANNEL AUDIO



(57) Abstract: The present invention provides a method of decoding two-channel matrix encoded audio (32) to reconstruct multichannel audio (34) that more closely approximates a discrete surround-sound presentation. This is accomplished by subband filtering (54) the two-channel matrix encoded audio, mapping (70) each of the subband signals into an expanded sound field (68) to produce multichannel subband signals, and synthesizing (78) those subband signals to reconstruct multichannel audio. By steering the subbands separately about an expanded sound field, various sounds can be simultaneously positioned about the sound field at different points allowing for more accurate placement and more distinct definition of each sound element.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H04R3/02 H04S3/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04S H04B H03G H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 630 168 A (NOKIA TECHNOLOGY GMBH) 21 December 1994 (1994-12-21) column 2, line 7 -column 3, line 9 column 4, line 7-53	1-4, 6-9, 11-16, 18, 19
Y	US 5 319 713 A (WALLER JR JAMES K ET AL) 7 June 1994 (1994-06-07) column 1, line 5-9 column 3, line 57 -column 10, line 28 column 11, line 25 -column 14, line 15	1-4, 6-9, 11-16, 18, 19
A	--- -/--	10



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Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 514 162 A (RUGGLES W) 14 June 1978 (1978-06-14) page 1, line 6-13 page 1, line 41 -page 13, line 7 page 13, line 39 -page 14, line 32 -----	1,2,4, 6-10, 12-16, 18,19
A	GB 2 269 969 A (SAMSUNG ELECTRONICS CO LTD) 23 February 1994 (1994-02-23) page 2, line 18 -page 5, line 7 page 5, line 19 -page 11, line 19 -----	1,3,5, 15-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US 01/30997

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0630168	A	21-12-1994	FI 932735 A	16-12-1994
			DE 69427001 D1	10-05-2001
			DE 69427001 T2	06-09-2001
			EP 0630168 A1	21-12-1994
US 5319713	A	07-06-1994	US 5333201 A	26-07-1994
GB 1514162	A	14-06-1978	DE 2512907 A1	09-10-1975
			NL 7503603 A	29-09-1975
GB 2269969	A	23-02-1994	JP 2509789 B2	26-06-1996
			JP 6112743 A	22-04-1994
			KR 139176 B1	15-06-1998
			US 5418859 A	23-05-1995